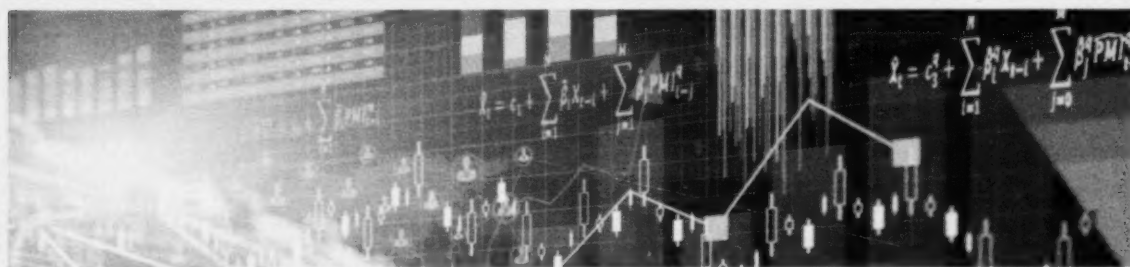




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Business Cycles in Small, Open Economies: Evidence from Panel Data Between 1900 and 2013

by

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Abstract

Using a novel data set for 17 countries dating from 1900 to 2013, we characterize business cycles in both small developed and developing countries in a model with financial frictions and a common shock structure. We estimate the model jointly for these 17 countries using Bayesian methods. We find that financial frictions are an important feature for not only developing countries but also small developed countries. Furthermore, business cycles in both groups of countries are marked with trend productivity shocks. Common disturbances explain one-third of the fluctuations in small, open economies (both developed and developing), especially during important worldwide phenomena.

Bank topics: Business fluctuations and cycles; Economic models; International topics

JEL classification: F41; F44; E13; E32

Résumé

Grâce à un nouvel ensemble de données sur 17 pays couvrant la période de 1900 à 2013, nous caractérisons les cycles économiques de petits pays développés et de pays en développement dans un modèle doté de frictions financières et d'une structure de chocs commune. Nous estimons le modèle pour les 17 pays collectivement en recourant à des méthodes bayésiennes. Nous constatons que les frictions financières constituent une caractéristique importante non seulement des pays en développement, mais aussi des petits pays développés. Par ailleurs, les cycles économiques des deux groupes de pays sont marqués par des chocs de productivité tendancielle. Les perturbations communes expliquent le tiers des fluctuations dans les petites économies ouvertes (qu'il s'agisse de pays développés ou de pays en développement), en particulier durant des phénomènes mondiaux importants.

Sujets : Cycles et fluctuations économiques; Modèles économiques; Questions internationales

Codes JEL : F41; F44; E13; E32

Non-Technical Summary

Motivation and Question

Previous studies have pointed out two key differences in the business cycles of emerging economies and advanced economies: the former exhibit more volatility in consumption relative to output and more countercyclical trade balance. Two views try to explain these features. Aguiar and Gopinath (2006) argue that these differences can be well explained by shocks to trend productivity that may reflect changes in economic policies and market failure. In contrast, Garcia-Cicco et al. (2010) show that financial frictions are better suited to capture the different dynamics in business cycles. Given the contrasting views of these studies, which use relatively few emerging countries, we try to answer the following questions. First, in the data, what are the key features of business cycles in developing countries, once we significantly extend the number of emerging countries and the time horizon in the analysis? Second, do financial frictions play a more prominent role than trend productivity shocks, once we employ a more general framework than those used in previous studies? Third, are business cycles in small developed countries different from those in developing countries?

Methodology

First, we document the main business cycles statistics for both small developed and developing countries using a novel and rich data set covering macroeconomic variables for 17 countries between 1900 and 2013. Then, we build a small open economy real business cycle model with reduced-form financial frictions and trend productivity shocks, augmented with common shocks that affect all countries at the same time. Our model nests those developed by Aguiar and Gopinath (2006) and Garcia-Cicco et al. (2010), which allows us to quantify the relative importance of their hypotheses. Finally, we estimate the model using Bayesian methods jointly for the 17 countries in our data set.

Key Contributions

First, we show that financial frictions are an important feature of business cycles in both small developed and developing countries. Second, contrary to previous literature, we find that trend productivity shocks play a sizable role in driving business cycles in both small developed and developing countries. However, the natures of trend productivity shocks are different: while common trend shocks are more important than country-specific shocks in developed economies, it is the opposite in developing countries. Third, common disturbances across countries are important drivers of business cycles.

Future Research

Our results suggest that future research should investigate the transmission mechanism of shocks and the general equilibrium effects from large countries to small open economy countries through international trade of both goods and financial assets.

1 Introduction

Recent studies have examined whether economic fluctuations in developing countries are described well by a frictionless real business cycle (RBC) model with shocks to trend productivity. Using data for Mexico, Aguiar and Gopinath (2007) argue that a frictionless RBC model with trend productivity shocks goes a long way in explaining business cycles in developing countries, as trend productivity shocks can capture frequent regime switches in economic policies and market failures, which are important for these countries. At the same time, Garcia-Cicco et al. (2010) show that an RBC model with a reduced-form financial friction describes the data for Argentina better than a frictionless model, and that it predicts the negligible role of trend productivity shocks in aggregate fluctuations. Given these contrasting conclusions coming from studies with relatively few countries, several questions on the nature of the business cycle in small open economies remain. First, what are the important features of economic fluctuations in developing countries in general? Do trend productivity shocks have a negligible role, while financial frictions are at the front and center? Second, are business cycles in small developed countries any different from those in developing countries over the long horizon?

This paper answers these questions in a unified framework of a structural model for small open economies and provides new evidence on the characteristics of business cycles using a novel panel data set covering over 100 years of data for 17 small developed and developing countries. Our structural model is a small open economy RBC model with financial frictions and common shocks. The financial friction feature of the model provides us with a framework to analyze whether a frictionless RBC model with trend productivity shocks or a model with financial frictions can better describe key features of business cycles in small open economies over the long horizon. Importantly, unlike previous papers in the literature, we introduce a common shock structure into the model to capture the possibility that these countries are subject to some common outside shocks and to better utilize the information from the panel data of many countries. More specifically, our model includes 17 small open economies, each of which faces a reduced-form financial friction modeled as an endogenous interest rate premium that responds to both the level of debt-to-output ratio and expected future productivity. The model economy is buffeted by five types of shocks including trend and stationary productivity shocks and country premium shocks, each of which has two components: a world common shock that affects all countries at the same time, and a country-specific shock. These common shocks are what connect these small open economies and can be

interpreted as outside shocks.

To facilitate our analysis, we estimate the model using a new data set covering 17 developing and developed small open economies between 1900 and 2013. Compared with previous studies, our data set includes many more countries over a much longer horizon, providing us with new evidence on the important features of business cycles in both small developed and developing economies, which has been limited in both sample countries and sample periods. Furthermore, given the panel structure of the data set, we pool all available information and estimate the model jointly for these countries. Therefore, we obtain efficiency gain in estimating key parameters and can identify structural shocks more accurately. Even though long data series may contain measurement errors, the fact that these series contain several business cycles makes them suitable for our purpose, to characterize observed business cycles and identify structural parameters in the model, especially those related to the trend productivity shock process. Furthermore, as we pool data in our estimation, the problem with measurement errors is less pronounced, to the extent that these measurement errors are independent across countries.

Our joint estimation for all 17 countries using Bayesian methods indicates that financial frictions are an important feature of business cycles in both small developed and developing countries. In other words, a frictionless RBC model is not supported by the data. In fact, all 17 small open economies in our sample face non-zero financial frictions, although the estimated degree of financial frictions varies across countries. Our estimation results suggest that while it is difficult for households to smooth their consumption by borrowing internationally, their borrowing constraint is also relaxed when their expected future productivity is high.

An important finding of our analysis is that trend productivity shocks play a sizable role in both small developed and developing countries. In particular, trend productivity shocks explain about one-third of output fluctuations in both small developed and developing countries, on average. This result is substantially different from previous studies on the importance of trend productivity shocks in emerging economies, such as Garcia-Cicco et al. (2010), who find that in an estimated model with financial frictions for Argentina, trend shocks are a negligible source of business cycles. Our estimation suggests that Argentina is a particular case, since in other countries such as Taiwan and Portugal, trend productivity shocks are large and significant even though these countries face substantial financial frictions. The contribution of trend productivity shocks is, on average, much larger than that in Argentina. Nevertheless, on average, trend plays a less significant role than stressed in Aguiar and Gopinath (2007), who examine Mexico after 1980. This result highlights

the importance of using information from many countries over the long horizon to understand the nature of business cycles in small open economies.

Although trend productivity shocks explain a significant fraction of business cycle fluctuations in both developed and developing countries, the natures of trend productivity shocks differ between these two groups of countries. When we decompose the importance of trend and stationary shocks into common and country-specific components, our estimation finds that while important trend shocks in small developed countries are common, country-specific trend shocks are much more dominant in developing countries. We interpret this result as follows: Developed countries are generally closer to the world productivity frontier, so they are more prone to common trend productivity shocks. However, developing countries are subject to various domestic policy and structural reforms, so the trend productivity shocks that are important for them are not common but country-specific.

Another finding in our paper is that common disturbances across countries are an important driving force of business cycle fluctuations in small open economies. These common shocks capture worldwide phenomena in the last 100 years such as the Great Depression, the two World Wars, the two oil price shocks and the Great Recession. During these episodes, output in all these countries dropped at the same time. Therefore, the estimation attributes a substantial fraction of business cycle fluctuations in both developed and developing countries to these common disturbances. In particular, all types of common shocks account for roughly 28% of output fluctuations at an annual frequency over the last 100 years. Furthermore, the extracted world common shocks are highly correlated with U.S. output over time. For example, in the 2008–09 recession, output in Canada and Mexico, which have strong ties with the U.S., declined significantly due to common shocks. These results suggest that the identified common shocks include the general equilibrium effects of shocks from large countries, such as the U.S., to 17 small open economies through financial and trade linkages.¹ Finally, we document that several sources of common shocks contribute to the fluctuations of macroeconomic variables, including common trend and stationary productivity shocks, as well as common premium shocks.

To examine whether business cycles have changed substantially over the last 100 years, we estimate the model for the two subsample periods before and after 1950. We find that the esti-

¹It is possible that our common shocks include the shocks originating from one of the 17 countries transmitting to the rest of the countries in the sample, which can overstate the importance of common shocks. However, this bias may be small. The reason is that since our sample includes 17 small open economies, shocks originating from Argentina or Canada are unlikely to affect other countries such as Taiwan or India. In other words, data from small open economies can help to avoid some of the internal propagation among countries in the group.

estimated parameters of the model, including those related to the financial friction, change over time, consistent with the fact that some of the second moments, such as volatilities in the data, are different across the two subsample periods. However, the main findings of our paper are robust: trend productivity shocks as well as common shocks play a sizable role in business cycles in these countries, and financial frictions are still an important feature for small open economies.

Although the identification in Bayesian estimation relies on all the information and moments in the data, our analysis suggests that the behaviors of trade balance, as well as output and consumption growth rates, help to pin down the importance of trend and productivity shocks. In particular, in a frictionless RBC model, although trend productivity shocks can lead to countercyclical trade balance and the excess volatility of consumption, trend productivity shocks lead to a near random-walk trade balance, as discussed in Garcia-Cicco et al. (2010). Therefore, observing trade balance is important in identifying whether a frictionless RBC model is adequate in explaining business cycles in small open economies or whether financial frictions are an important feature for these economies. Furthermore, observing output and consumption growth rates over the long horizon also helps to identify the persistence of productivity shocks, and the estimation to distinguish trend and stationary productivity shocks. We identify the common components of these shocks through both contemporaneous and dynamic correlations across all country pairs. In the model, since each country is a small open economy, there is no correlation across countries without common shocks. Therefore, the estimation attributes the comovements across all countries to world common shocks, and the fluctuations independent of other countries to country-specific shocks. This identification implies that common shocks tend to be more important for countries that are more correlated with the rest of the countries in the sample, which is consistent with our findings.

Related Literature Our paper is related to several strands of the macroeconomics literature. First, we contribute to a large literature in the small open economy business cycle studies, starting with Mendoza (1991), by providing new evidence on the role of trend shocks and financial frictions in a large number of countries.² These papers often focus on only a few countries, such as Argentina and Mexico, and use short time series. Although Garcia-Cicco et al. (2010) use 100 years of data, their sample countries are also limited to Argentina and Mexico.³ We complement these papers

²A number of papers including Neumeyer and Perri (2005), Uribe and Yue (2006), Aguiar and Gopinath (2007), Chang and Fernandez (2013), Alvarez-Parra et al. (2013), Fernández-Villaverde et al. (2011), and Fernandez and Gulan (2015) have highlighted the role of interest rate, the changes in interest rate volatility, trend shocks and financial frictions in business cycles in emerging economies.

³Nakamura et al. (2014) estimate a trend component using consumption data for 16 developed countries spanning 100 years in a long run risk model.

along several dimensions. We estimate trend shocks using a new data set that covers many more countries, spanning over a century. Our finding about the importance of trend shocks in these countries suggests that trend shocks are neither dominant nor negligible as earlier works with only a few countries have found. Furthermore, we also highlight the role of financial frictions in developing countries, unlike Naoussi and Tripier (2013), who use shorter data for 82 countries but restrict their attention to a frictionless model with trend shocks. This finding resonates with recent work by Akinci (2014) and Fernandez and Gulan (2015), who quantify the role of financial frictions in a micro-founded financial friction model using recent data. Finally, an important difference between our papers and earlier work in this literature is that we exploit the information from the long panel data to examine the common components of trend shocks and how financial frictions have changed over time for these small open economies.⁴

Our paper also provides new evidence of the role of common shocks to the existing literature on world business cycles. Structural studies such as Glick and Rogoff (1995) and Gregory and Head (1999) distinguish the effects of common and country-specific shocks, but do not estimate the model. Therefore, they do not address our questions on business cycles in small open economies. A recent work by Gueron-Quintana (2013) estimates the role of common shocks in small developed countries using quarterly data from 1980. Our paper, instead, focuses on business cycle characteristics for not only small developed countries but also emerging countries over 100 years. Besides, our model features an endogenous interest rate premium to proxy for the reduced-form financial friction in these countries, as well as a flexible common shock structure to capture the observed comovements in the data. Both differences matter for the results, as they affect identification and fitness of the model.

We also speak to a large literature on understanding world business cycles using reduced-form dynamic factor models (DFM) such as Kose et al. (2003, 2012). An important contribution of our paper is that we identify several types of structural common shocks and their propagation mechanism, which is difficult in a standard DFM approach. If we used standard DFM estimation in the international business cycle literature, which typically assumes one type of common factor, we would estimate a much more modest role of common shocks—about half of the result in the structural estimation. We demonstrate this difference between structural and DFM methods by showing that DFM estimates a much lower importance of common shocks when the data-generating

⁴A few other papers such as Kose (2002) and recently Fernandez et al. (2015) explore the role of commodity prices in driving business cycles in small open economies. We do not specify the commodity prices in our model, but we can interpret that some of the shocks we identify come from the fluctuations in commodity prices.

process has more than one type of common shock.⁵

The rest of the paper is organized as follows: Section 2 documents the main business cycle statistics of small developed and developing countries between 1900 and 2013. Section 3 describes the baseline model. We explain the estimation method and the identification issues in Section 4. We discuss the role of financial frictions in Section 5. We present our main findings on the relative role of trend and stationary shocks and the nature of these shocks in Section 6 and 7. Section 8 analyzes the role of common shocks in small open economies. Section 9 discusses the robustness of our findings when we look at two subsample periods in our data. Section 10 concludes.

2 Business Cycles in Small Open Economies: 1900–2013

This section documents the main business cycle statistics for small open economies using a novel data set covering 17 countries in the last 100 years.

Our new data set includes annual growth rates of output, consumption, investment and the trade balance-to-output ratio for 17 small developed and developing countries between 1900 and 2013. Output, consumption and investment are deflated by the GDP deflator and in per capita terms. We start our data set with countries that have output and consumption data in Barto and Ursua (2010). We exclude large countries such as the United States, Japan, Germany, France and the United Kingdom, which represented more than 2% of the world's GDP in the year 2000. We then collect data on investment and trade balance for the remaining countries from various sources, such as national statistics offices and economic history publications.⁶ Since the data for many countries start after World War II and the motivation of the paper is to use long data series to identify trend shocks, we choose only countries with at least 89 years of data, leaving these 17 countries.⁷

We categorize the countries into two groups based on their present development level, similar to Kose et al. (2012). Our classification is also consistent with that of Morgan Stanley Capital International (MSCI), which is used in Álvarez-Parra et al. (2013).⁸ There are 10 developing countries (Argentina, Brazil, Chile, Colombia, India, Mexico, Peru, Taiwan, Turkey and Venezuela)

⁵ Our results may be consistent with the DFM approach that identifies several common factors. However, a standard DFM estimation is not adequate to address our research questions; i.e., to understand the role of financial frictions as well as the nature of driving forces in business cycles and the propagation mechanisms.

⁶Detailed data sources are listed in Appendix C.

⁷Data availability for the countries in our data set is detailed in Appendix Table A1.

⁸We classify a country as developed if the country was in the MSCI Developed Markets index in their classification and as having an emerging market otherwise.

and seven small developed countries (Australia, Canada, Finland, Norway, Portugal, Spain, and Sweden). This grouping helps us characterize the differences between small developed countries and developing countries.⁹

2.1 Within-Country Statistics

[Insert Table 1 around here]

Whole sample: 1900–2013. Some features of our long time-span data set are similar to the facts previously documented in shorter data series. First, business cycles in many developing countries are characterized by a more volatile consumption growth rate than output growth rate, as shown in column (1) and column (2) of the “Developing” panel in Table 1. This feature also holds, on average, across small developed countries. Second, investment is the most volatile variable in every country in the sample, as displayed in column (3) of Table 1. Third, consistent with standard business cycle facts, consumption and investment are positively correlated with output. Lastly, the autocorrelation of trade balance is high, as reported in column (13) of Table 1. We also find that the trade balance autocorrelation function tapers off quickly for all countries, similar to that reported in Garcia-Cicco et al. (2010) using shorter data.¹⁰

Our data set also exhibits several features that are different from the previously documented facts. First, consumption volatility is higher than output volatility in small developed countries, on average. As reported in the first two columns of Table 1, this is true for five out of seven small developed economies. The excess volatility of consumption is in contrast with previous studies such as Aguiar and Gopinath (2007), who find this feature prominent only for developing countries using quarterly data after 1980, but consistent with other studies that use annual data from 1960, such as Crucini and Chen (2011) and Rondeau (2012). Second, there is no strong pattern for trade balance in small developed countries. Three out of seven small developed countries have a countercyclical trade balance, as shown in column (7) of Table 1, while the other four countries have a mildly procyclical trade balance. Thus, the average correlation of output and trade balance across countries is only slightly positive.

⁹Previous literature estimates global business cycles by grouping countries based on geographical locations. We do not estimate such group components, because there are only one or two countries in some regions, which can be a problem when we want to identify the regional shocks. We can identify the group components if we divide the group based on the levels of development in the estimation. However, some countries such as Argentina may have switched between developed and developing groups over the entire 100 years, so we do not estimate the group components in the baseline.

¹⁰We plot the autocorrelation function for all countries in Figure A2.

Since many small open economies have gone through substantial changes in the last 100 years, we report the business cycle statistics in small open economies in two subperiods: between 1901 and 1950, and between 1951 and 2013. We choose the break point at 1950 to avoid some of the lasting effects of World War II.¹¹ Table 2a reports the second moments averaged across all countries, all developed and developing countries in these two periods.

[Insert Table 2a Table 2b around here]

Subperiod: 1901–1950. During the first half of the 20th century, output, consumption and investment growth rates are much more volatile in both small developed and developing countries than in the whole sample. However, we still find that consumption is 50% more volatile than output in all countries, and investment is three to four times more volatile than output. The correlation between output and trade balance and the autocorrelation of all four variables are consistent with the statistics for the whole period. For example, output comoves positively with consumption and investment in all countries. Trade balance is countercyclical in developing countries, but acyclical in small developed countries. Overall, the main difference between this subperiod and the whole sample is that output, consumption and investment are substantially more volatile in this subperiod.

Subperiod: 1951–2013. One important difference between this subsample and the whole sample is that the volatilities of output, consumption and investment are much smaller in the period between 1951 and 2013. This pattern is true for not only small developed countries, but also developing countries. Trade balance, on the other hand, remains as volatile as the whole sample and the 1901–1950 period.¹² Other characteristics we document in the whole sample remain the same. For example, consumption is still, on average, more volatile than output in both developed and developing countries. Investment is still the most volatile component. Finally, the countercyclicity of trade balance remains similar to that of the whole sample.¹³

¹¹García-Cicco et al. (2010) compares output volatilities before and after 1945. Romer (1999) divides the sample for the United States into: Pre World War I (1886–1916), Inter War (1920–40), Post World War II (1948–97).

¹²We formally test the differences in the standard deviation of output, consumption, investment and trade balance between two subperiods for each country. We find that for output, we can reject the hypothesis that the standard deviations are equal between the two subperiods for all countries, except for Argentina, Brazil, Peru and India, at the 5% significance level. We can reject the same hypothesis for consumption and investment of all countries except three. Trade balance results are mixed: we can reject the hypothesis for only nine out of 17 countries.

¹³In the recent period between 1980 and 2013, most of the second moments for these countries remain similar to those of the 1950–2013 period. The main difference is that the volatilities of output and consumption in developed countries decrease further compared with the whole period and the 1950–2013 period. Since there have been only a few business cycles since 1980 for most of these countries, which makes it difficult to reliably identify trend shocks, our robustness check does not estimate the model using this subsample, but only the 1950–2013 period data.